

REMARKS

The Official Action of July 21, 2006, and the prior art relied upon therein have been carefully reviewed. The claims in the application are now claims 1-18, and these claims define patentable subject matter warranting their allowance. Applicants respectfully request favorable reconsideration and allowance.

Acknowledgement by the PTO of the receipt of applicants' papers filed under Section 119 is noted.

Claim 1 has been cosmetically amended above to more completely recite what the heat-resistant material is, i.e. it is a resin binder material as pointed out in applicants' specification, for example at page 7, lines 1 and 9-10.

New claims 6-18 have been added. Claims 6 and 7 correspond to claim 4 dependent respectively on claims 2 and 3. Claims 8-12 correspond to claim 5, respectively dependent on claim 2-7. Claims 16 and 13 find support respectively at page 10, lines 4-10 and 22. Claims 14 and 15 find support respectively at page 4, lines 13-16 and 24-26. Claims 17 and 18 find support respectively at page 7, lines 15-19 and 23-25. The newly added claims are patentable for the same reasons as claim 1 from which they depend, as pointed out below.

Claims 1-5 have been rejected as obvious under §103 from Onoda et al USP 5,531,195 (Onoda) in view of JP 57/74334 (JP '334). This rejection is respectfully traversed.

As is acknowledged in the rejection, Onoda discloses a piston ring with a nitride layer 6 and a resin coating having a solid lubricant dispersed therein, but does not disclose applicants' claimed resin coating, namely a polyamideimide-silicon dioxide hybrid or a polyamide-silicon dioxide hybrid. Nevertheless, the PTO takes the position that such a material is however disclosed in JP '334, and that it would have been obvious to substitute the coating material of JP '334 for that of Onoda and thereby obtain the claimed subject matter.

However, it is not correct that JP '334 discloses applicants' resin coating material, or that it would have been obvious to use applicants' binder material in place of the resin coating of Onoda, or that there would have been a reasonable expectation of the success achieved according to the present invention by such a substitution. Thus, none of the three criteria for the establishment of a *prima facie* case of obviousness, as set forth in MPEP 2143, exist in the present rejection.

As the rejection relies so heavily on JP '334, it needs to be emphasized that JP '334 does not disclose applicants' resin binder material, contrary to what is stated in the rejection. Instead, JP '334 discloses a sliding material

obtained by hot pressing a powder mixture consisting of carbon, amorphous silica and a resin binder in a specified proportion (see ABSTRACT of JP '334 attached to the Office Action). This mixed material of JP '334 is essentially different from the hybrid material of the present invention.

On the other hand, applicants heat-resistant resin binder material comprises a polyamideimide-silicon dioxide hybrid material (hybrid material of polyamideimide and silicon dioxide) and/or a polyimide-silicon dioxide hybrid material (hybrid material of polyimide and silicon dioxide) forming the resin coating film as a binder, the term "hybrid material" used herein meaning a so-called organic-inorganic hybrid material, in which an organic material and a metal oxide are coupled or chemically combined. Thus, the organic-inorganic hybrid material is not a simple mixture of an organic compound and an inorganic compound, but a composite product homogenized to a molecular level in a synthesis step; see page 7, line 5 to page 8, line 1, particularly page 7, lines 6-15 of the specification, the latter of which states:

The heat-resistant material comprises a polyamideimide-silicon dioxide hybrid material (hybrid material of polyamideimide and silicon dioxide) and/or a polyimide-silicon dioxide hybrid material (hybrid material of polyimide and silicon dioxide) to compose the resin coating film as a binder. The term "hybrid material" used herein means a so-called organic-inorganic hybrid material, in which an organic material and a metal oxide are coupled or

combined. The organic-inorganic hybrid material is not a simple mixture of an organic compound and an inorganic compound, but a composite product homogenized to a molecular level in a synthesis step.

It is clear that JP '334 does not disclose or indeed remotely suggest or infer applicants' heat-resistant plastic binder material.

Accordingly, even if the combination were obvious, the resultant reconstruction of Onoda would not correspond to the claimed subject matter. Moreover, insofar as is known, there is no prior art which would have made it obvious to use applicants' heat-resistant resin binder material in place of the resin coating of Onoda.

JP '334 is quite similar to the acknowledged prior art as set forth in applicants' specification at the bottom of page 2 and also the bottom of page 3, the former of which states as follows:

In the method disclosed in JP 62-233458 A, a coating film having a solid lubricant such as molybdenum disulfide dispersed in a heat-resistant resin such as an epoxy resin, a phenol resin, a polyamide resin and a polyimide resin is formed on a side surface of a piston ring. The content of the molybdenum disulfide solid lubricant is desirably 60 to 95% by mass, and a friction coefficient between the ring groove and the side surface of the piston ring is reduced by cleavage of the solid lubricant. Though the solid lubricant decreases the wear of the ring grooves of the piston, the wear cannot completely be prevented because of the softness of the

heat-resistant resin used as a coating matrix material. Thus, the piston rings provided by the methods are insufficient in durability though these methods are effective for preventing the aluminum adhesion at the initial stage. Particularly in high-output engines, the resin coating films wear in a relatively short period by high temperatures and collision, bringing the side surfaces of the piston rings into contact with the aluminum alloy ring grooves, thereby causing the aluminum adhesion.

The polyimide resin is too soft.

And from the disclosure in the paragraphs spanning pages 3 and 4:

To prevent the aluminum adhesion, polyamideimide (PAI) has been mainly used as a binder for the conventional coatings. Though the polyamideimide is a resin with excellent heat resistance and softness, it is a polar polymer having high hygroscopicity. Therefore, when coming into contact with moisture generated by the combustion of hydrocarbon-based fuels at high temperatures, the polyamideimide is likely to absorb the moisture. The moisture absorption turns the polyamideimide remarkably poor in mechanical strength, softness, and adhesiveness to the substrate, so that the coating films containing the polyamideimide as a binder are easily broken or peeled off, and worn out when repeatedly collided and slid in engines at high temperatures. The same is true for polyimide (PI). It is thus presumed that the moisture absorption of binders provides the conventional resin coating with insufficient durability.

Because of the nature as organic polymers, polyamideimide and polyimide are easily oxidized or decomposed at high temperatures. Thus, the polymers are disadvantageously poor in durability in

engines with high combustion temperatures, so that they may not be able to be adapted for increased piston ring temperatures because of higher position of top piston rings for higher engine output and stricter exhaust gas regulations.

As in the acknowledged prior art, the resin of JP '334 uses an unmodified polyimide, and consequently can be considered to suffer the same deficiencies as the acknowledged prior art as noted in applicants' specification and quoted above.

Nor does the prior art provide any reasonable expectation of the success achieved according to the present invention which makes it "possible to provide a resin coating film for piston rings with improved heat resistance, mechanical strength and adhesiveness to the piston ring substrate, and with reduced hygroscopicity and wear rate, thereby preventing the adhesion of aluminum to the side surface of the piston ring for a long period of time, (Specification page 5, lines 18-22)."

Moreover, the exceptional success of the present invention is demonstrated in the comparative examples. Please note that the comparative examples set forth in applicants' specification, commencing at the bottom of page 14 and extending through page 15, provide coatings not unlike that of JP '334. The results of the comparative absorption tests are set forth in table 2 on pages 17 and 18 where it is shown that the moisture absorption coefficient of applicants' coating was considerably lower than that of the comparative examples; and the results of adhesiveness

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tests are shown in table 3 at page 18 where again the present invention is shown to be radically successful compared with the comparative products.

Withdrawal of the rejection is in order and is respectfully requested.

With regard to the parameters set forth in claims 2, 4 and 5, as well as new claim 13, applicants cannot accept what is in effect "Official Notice" that something would be obvious without there being any evidence of such obviousness¹. Any applicant has a right to face whatever evidence may exist with respect to obviousness so as to be able to rebut such evidence. Accordingly, if the PTO is to maintain that the parameters in claims 2, 4, 5 and 13 would obviously have been used in Onoda, then applicants need to see whatever prior art may exist and how such prior art would have been combined with Onoda to show the claimed invention to have been obvious.

The prior art documents of record and not relied upon by the PTO have been noted, along with the implication that such documents are deemed by the PTO to be insufficiently material to warrant their application against any of applicants' claims.

Applicants believe that all issues raised in the Office Action have been addressed above in a manner favorable to

¹ If Hannig USP 5,560,283 is to be relied upon, it should be included in the statement of the rejection. In any event, applicants do not see that Hannig discloses or makes obvious all of the recited parameters.

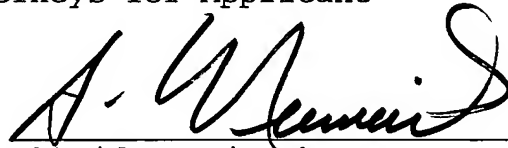
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allowance of the present application. Accordingly, applicants respectfully request favorable reconsideration and early formal allowance.

Respectfully submitted,

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By

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